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A

HISTORY

OF

BRITISH REPTILES.

BY

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ILLUSTRATED BY A WOODCUT OF EACH SPECIES, WITH SOME OF THE VARIETIES, AND NUMEROUS VIGNETTES.

LONDON:

JOHN VAN VOORST, 1, PATERNOSTER ROW;

BOOKSELLER TO THE ZOOLOGICAL SOCIETY.

S. BENTLEY, [1 *February*, 1839.] DORSET STREET.

In consequence of numerous suggestions which have been received, and in order to accommodate the work as much as possible to unscientific readers, a Glossary of Technical and Scientific Terms will be given in the concluding Part.

JOHN VAN VOORST 1, PATERNOSTER ROW.

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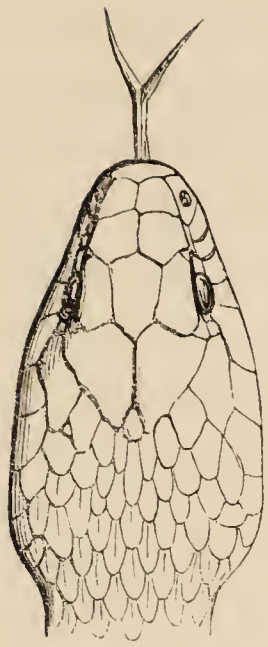
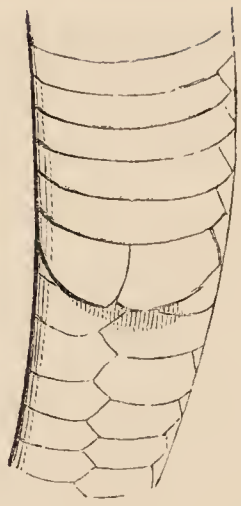




It is by far the most common of our true reptilia, if we except the little Lizard, *Zootoca vivipara*. It inhabits all our woods and heaths and hedgerows, especially in the neighbourhood of water, feeding upon young birds, and even eggs, or mice, and other small quadrupeds, and lizards; but, in preference to all these, upon frogs. I have seen one of these voracious creatures in pursuit of a frog, which appeared perfectly conscious of its approaching fate, leaping with less and less power as it found its situation more hopeless, and the crisis of its fate approaching, and uttering its peculiar weak cry with more than usual shrillness, until at length it was seized by its pursuer by the hinder leg, and gradually devoured. The manner in which the Snake takes its prey is very curious. If it be a frog, it generally seizes it by the hinder leg, because it is usually taken in pursuit. As soon as this takes place, the frog, in most instances, ceases to make any struggle or attempt to escape. The whole body and the legs are stretched out, as it were, convulsively, and the Snake gradually draws in first the leg he has seized, and afterwards the rest of the animal, portion after portion, by means of the peculiar mechanism of the jaws, so admirably adapted for this purpose. It must be recollected

that in the true Serpents, unlike the group to which the Slow-worm belongs, the bones of which the upper and lower jaw are composed, are perfectly and loosely distinct from each other, and connected only by ligaments. By this arrangement not only is great dilatability of the mouth obtained, which is also aided by a peculiarity in the structure of the joint, but one side of either jaw is capable of acting independently of the other; and as the animal is gradually taking its prey, one side of the jaws is extended forwards, and the two rows of teeth of the upper, and the single row of the lower, fixed into the integument; then the opposite side of the jaws is stretched forwards in the same manner, and so on alternately until the victim is thus gradually and often slowly conveyed into the œsophagus, and by the muscular action of this part it is swallowed. When a frog is in the progress of being swallowed in this manner, as soon as the Snake's jaws have reached the body, the other hinder leg becomes turned forwards; and as the body gradually disappears, the three legs and the head are seen standing forwards out of the Snake's mouth in a very singular manner. Should the Snake, however, have taken the Frog by the middle of the body, it invariably turns it by several movements of the jaws, until the head is directed towards the throat of the Snake, and it is then swallowed head foremost. This process will remind all who have witnessed the curious sight of the great Boa taking its food, of the manner in which that enormous reptile effects its deglutition, after it has, by the pressure of its mighty sides, killed and crushed the bones of its victim.

The scene above described is one which I have often witnessed; and I once saw two Snakes seize upon the same hapless frog. As this circumstance is not unlikely to happen in their native state, it may not be out of place to mention the result. On placing a frog in a large box, in which were several Snakes, one of the latter instantly seized it by

one of the hinder legs, and immediately afterwards another of the Snakes took forcible possession of the fore-leg of the opposite side. Each continued its inroads upon the poor frog's limb and body until at length the upper jaws of the two Snakes met, and one of them in the course of its progress slightly bit the jaw of the other; this was retaliated, though evidently without any hostile feeling; but after one or two such accidents, the most powerful of the Snakes commenced shaking the other, which still had hold of the frog, with great violence, from side to side, against the sides of the box. After a few moments' rest, the other returned the attack, and at length the one which had last seized the frog, having a less firm hold, was shaken off, and the victor swallowed the prey in quiet. No sooner was this curious contest over than I put another frog into the box, which was at once seized and swallowed by the unsuccessful combatant.

The frog is generally alive not only during the process of deglutition, but even after it has passed into the stomach. I once saw a very small one, which had been swallowed by a large Snake in my possession, leap again out of the mouth of the latter, which happened to gape, as they frequently do immediately after taking food. And on another occasion, I heard a frog distinctly utter its peculiar cry several minutes after it had been swallowed by the Snake. In taking lizards or birds, it always, as far as my own observation goes, swallows the head foremost. After it has taken its food, it usually remains inactive for many days, not usually seeking a fresh meal until the former one is digested. So exclusively are all Serpents animal feeders, that they not only will not take, but cannot digest, vegetable matters. This is shown in a very striking manner by a fact which I have witnessed in the case of a Boa which was in the menagerie formerly kept at the Tower. This creature was accustomed to have fowls given to it; and after this food was digested, and the remains were voided,

any corn which might happen to have been in the crop of the fowl when it was taken, was always found mingled with the excrement, but wholly unchanged.

Snakes are extremely fond of water, taking to it readily, and swimming with great ease and elegance, holding the head and neck above the surface. It is very probable that it resorts to the water in search of frogs.

Snakes, like most other Reptilia, shed their cuticle or outer skin at greater or less intervals. It is a mistake to assign a particular period to this process; some have stated it to occur once, some twice in the summer; but I have found it to depend upon the temperature of the atmosphere, and on the state of health, and the more or less frequent feeding of the animal. I have known the skin shed four or five times during the year. It is always thrown off by reversing it; so that the transparent covering of the eyes, and that of the scales also, are always found concave in the exuviæ. Previously to this curious circumstance taking place, the whole cuticle becomes somewhat opaque, the eyes are dim, and the animal is evidently blind. It also becomes more or less inactive; until at length when the skin is ready to be removed, being everywhere detached, and the new skin perfectly hard underneath, the animal bursts it at the neck, and creeping through some dense herbage, or low brushwood, leaves it attached, and comes forth in far brighter and clearer colours than before.

Like most Serpents, the Snake has the power of expelling from certain glands, situated within the vent, a most disgusting stinking secretion. This is only done when alarmed or irritated, or when under sexual excitement; in the latter case it is most probably intended as a means of directing the other sex in the pursuit.

This species, and indeed the whole genus, is truly oviparous, depositing its eggs a considerable time before the young

ones are hatched, and leaving them to be vivified and developed by the heat of the sun, or of a dung-heap. The eggs are connected together by a glutinous matter, and are generally from sixteen to twenty in number. It is certainly remarkable, considering that the normal character of the whole class of reptiles is truly oviparous, that of our five indigenous species of true *Reptilia*, the minority only should deposit their eggs before the young are developed and hatched—the present species, and the *Lacerta agilis ;* the latter, too, a recent addition to our known Fauna.

Towards the end of autumn, or earlier, they resort to their place of hibernation, in some sequestered and sheltered corner, as the hollow roots of a tree, under hedges or brushwood, or similar places of security, where they remain, coiled together, sometimes in considerable numbers, throughout the whole of the inclement season ; and with the first return of warmth they come forth with all the other tribes which pass the winter in torpidity, and resume all the functions of life.

The Common Snake is easily tamed, and may be made to distinguish those who caress and feed it. I had one many years since, which knew me from all other persons ; and, when let out of his box, would immediately come to me, and crawl under the sleeve of my coat, where he was fond of lying perfectly still, and enjoying the warmth. He was accustomed to come to my hand for a draught of milk every morning at breakfast, which he always did of his own accord ; but he would fly from strangers, and hiss if they meddled with him.

It inhabits most of the countries of Europe, from Scotland and the corresponding latitude of the Continent, to Italy and Sicily. In all parts of England it is exceedingly common ; frequenting generally places in which there is ready access to water, and hence it is found in more humid places than the Viper.

So much has been said of the inability of reptiles of every

kind to exist in Ireland,—or at least of their non-existence in that island, that I have endeavoured to ascertain exactly to what extent these statements are correct. I have already mentioned the existence of the *L. agilis* there, and with regard to the present species, the following is the result of my inquiries. It would appear not only that the Common Snake is not indigenous to Ireland, but that several attempts to introduce it have totally failed. Mr. Ball some time since informed me of some trials of this kind; and the following letter, which I have recently received from Mr. Thompson, gives a very detailed and clear account of the actual facts.

"In this order (*Ophidia*) there is not now, nor I believe ever was there, any species indigenous to Ireland. In the Edinburgh New Philosophical Journal for April 1835,* it is remarked, 'We have learned from good authority that a recent importation of Snakes has been made into Ireland, and that at present they are multiplying rapidly within a few miles of the tomb of St. Patrick.' I never," proceeds Mr. Thompson, "heard of this circumstance until it was published, and subsequently endeavoured to ascertain its truth, by inquiring of the persons about Downpatrick, (where the tomb of St. Patrick is,) who are best acquainted with these subjects, not one of whom had ever heard of Snakes being in the neighbourhood. Recollecting that about the year 1831 a Snake (*Natrix torquata*), immediately after being killed at Milecross, was brought by some country people in great consternation to my friend, Dr. J. L. Drummond, I thought this might be one of those alluded to; and recently made inquiry of James Clealand, Esq. of Ruth Gael House (county Down), twenty-five miles distant in a direct line from Downpatrick, respecting Snakes said to have been turned out by him; I was favoured by that gentleman with the fol-

* Vol. XVIII. p. 373.

lowing satisfactory reply :—'The report of my having introduced Snakes into this country is correct. Being curious to ascertain whether the climate of Ireland was destructive to that class of reptiles, about six years ago I purchased half a dozen of them in Covent Garden Market in London; they had been taken some time, and were quite tame and familiar. I turned them out in my garden; they immediately rambled away; one of them was killed at Milecross,* three miles distant, in about a week after its liberation; and three others were shortly afterwards killed within that distance of the place where they were turned out; and it is highly probable that the remaining two met with a similar fate, falling victims to a reward which it appears was offered for their destruction.'"

Such is the most accurate and authentic account which I have yet obtained respecting this curious fact in the geographical distribution of these animals; and it certainly does not appear that the failure of these attempts to introduce Snakes into Ireland is to be attributed to anything connected with the climate, or other local circumstances, but rather to the prejudices of the inhabitants which led to their destruction, nor is there reason to believe that their absence from Ireland is other than purely accidental.

This species grows to the length of more than three feet, sometimes, though rarely, of four feet. The head is considerably depressed, of an elegant ovate form, the back part broader than the neck; the gape is of the length of the head, and slightly curved, rising posteriorly. The teeth are small, curved backwards, and, as in all the other innocuous Snakes, arranged in two series on each side of the jaw both above and below. Plates of the head broad and flat; labial plates seven. Tongue long, excessively flexible, bifid to about one

* This was the one before alluded to, as having been brought to Dr. Drummond.

third its length. Body very long; the median line of the back elevated; the neck narrowed; the tail very tapering, moderately pointed at the extremity, occupying generally about one-fifth of the entire length. Scales of the back oval, imbricated, each having a distinct carina, those of the sides broader and with the carina less marked, and becoming almost obsolete. Abdominal plates broad, transverse, in number about one hundred and seventy; subcaudal plates from sixty to sixty-five pairs.

The upper parts of the body and head are of a light brownish grey with a green tinge, sometimes approaching to a dull, pale olive. The labial plates separated by distinct black lines. Behind the head, on the upper part, is a broad collar, or two lunate spots of a bright yellow colour, and immediately behind these are two broad transverse spots of black, which are also sometimes separate, at others confluent. Two rows of small black spots arranged alternately down the back, and larger ones at the sides; all of which vary in size, as well as in the degree of their approximation to each other. Abdomen of a dull pale bluish, or plumbeous colour, in many specimens marbled with black.

The female, as in all Ophidians, is always much larger than the male.

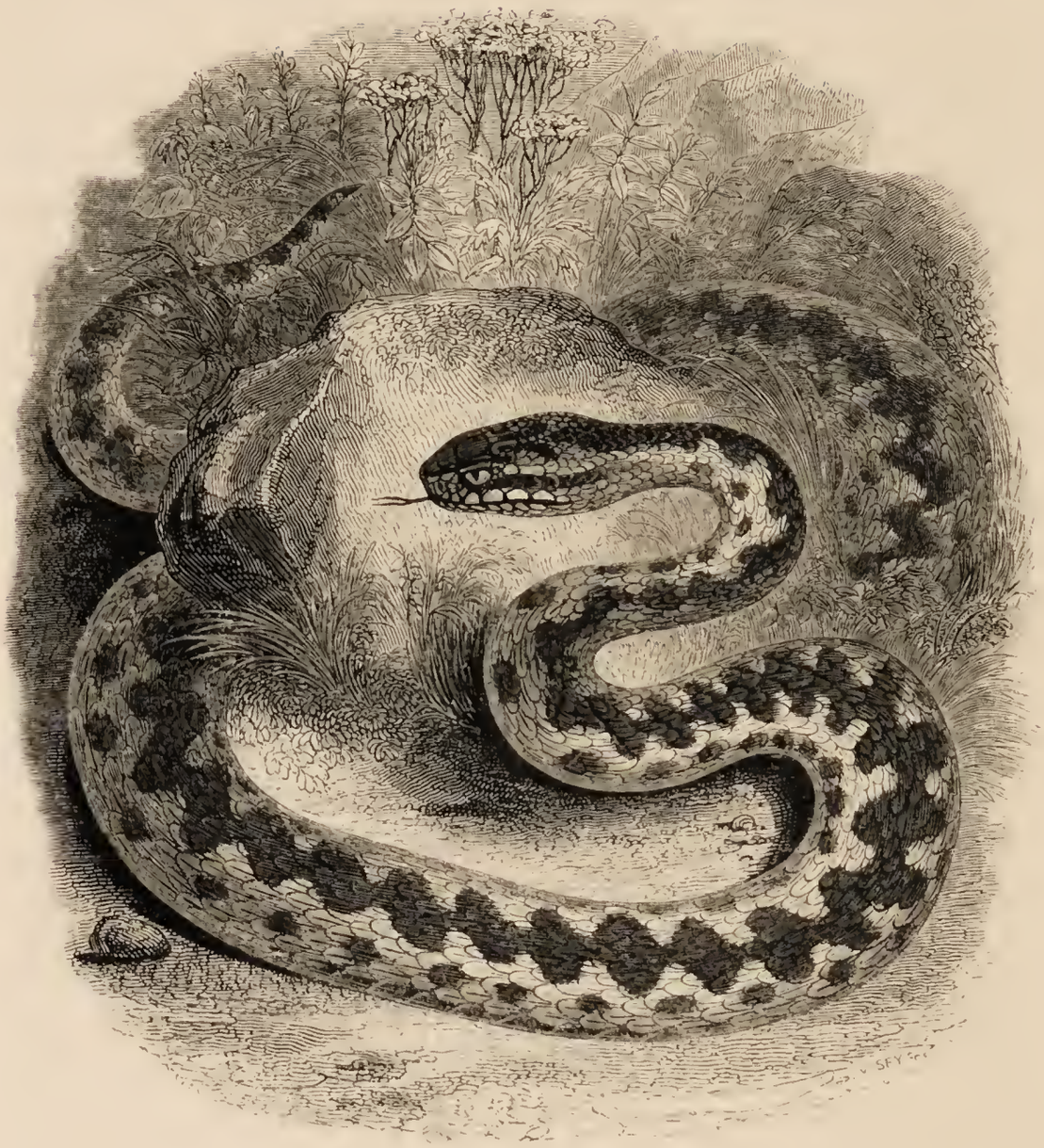
Coluber Dumfrisiensis. Sowerb.

Many years since a small Snake, having the characters of one of the *Colubridæ*, was taken by Mr. J. W. Simmons, near Dumfries. It was published as a new species by Mr. Sowerby in his British Miscellany, and figured in the third plate of that work. It was there named *Coluber Dumfrisiensis*. The specimen remained until within the last few years in the possession of Mr. Sowerby's family; but having come into my hands, it was unfortunately lost or mislaid, and I have never since been able to recover it. There is, I think, great reason to believe that it was a very young *Natrix torquata*, but differing certainly in many respects from the usual appearance and characters of that species. It was about three or four inches in length; "of a pale brown colour, with pairs of reddish brown stripes from side to side, over the back, somewhat zigzag, with intervening spots on the sides." The most remarkable peculiarity mentioned, however, is that "the scales are extremely simple, *not* carinated." The abdominal plates were one hundred and sixty-two; those under the tail about eighty. This is all the information at present possessed respecting the species, if it be indeed a species. Mr. Jenyns, in his excellent Manual, expresses the opinion which I have given above, that it is "probably an immature variety of the common species."

See Sowerby's Brit. Miscell. p. 3, t. iii.; also Loudon's Mag. Nat. Hist. II. p. 438, where the original figure is copied.

SQUAMATA.
(OPHIDIA.)

VIPERIDÆ.



Genus, *Pelius*. Merr.

Generic Character.—Head depressed, oblong-ovate, somewhat compressed before, and wider behind the eyes; vertex covered with scuta; no pit between the nostrils and eyes; tail with double plates beneath.

COMMON VIPER.

ADDER.

Pelius Berus.

Specific Character.—Brown, with a series of confluent rhomboidal black spots along the back.

Vipera, Ray, Syn. Quad. et Serp. p. 285.
Coluber Berus, Linn. Syst. Nat. I. p. 377. Laur. Spec. Med. p. 97. Shaw, Gen. Zool. III. p. 365, t. ci. Turton, Brit. Faun. p. 80.
Vipera ,, Daud. Hist. Rept. VI. p. 89.
,, *vulgaris*, Latr. Rept. III. p. 812.
,, *communis*, Leach, Zool. Miscell. III. t. vii. Flem. Brit. Anim. p. 156. Jenyns, Brit. Vert. p. 297.
Pelias Berus, Merrem, Syst. Amph. p. 148, sp. 1, α. β. γ. Bonap. Faun. Ital. cum. fig.
Vipère commune, Daud. l. c. (an Cuv.?)
Viper, Pennant, Brit. Zool. III. p. 26, t. iv.

Var. β.
Red Viper, Rackett, in Linn. Trans. XII. p. 349.
Coluber chersea? Linn. Syst. Nat. p. 337.

Var. γ.
Blue-bellied viper, (*Coluber cæruleus*,) Shepp. in Linn. Trans. VII. p. 56.

Var. δ.
Black Viper, Leach, Zool. Misc. loco cit.

The Common Viper is happily the sole British representative of any of the poisonous groups of Serpents, and indeed the only poisonous reptile indigenous to this country. It is far more numerous in Scotland than the Common Snake, and is found in abundance in all parts of England and Wales, frequenting heaths, dry woods, and banks. In Ireland it has never been seen; and it may, almost with certainty, be stated that it does not exist there. On the continent of Europe it is extensively distributed, being found from the northern parts of Russia to the south of Italy and Spain. It is everywhere deservedly feared on account of its venom, which, although less virulent than that of many other species, is yet sufficiently so to produce severe symptoms, and sometimes, in the warmer climates, even fatal results. In this country I have never seen a case which terminated in death, nor have I been able to trace to an authentic source any of

the numerous reports of such a termination, which have at various times been confidently promulgated. At the same time the symptoms are frequently so threatening, that I cannot but conclude that in very hot weather, and when not only the reptile is in full activity and power, but the constitution of the victim in a state of great irritability and diminished power, a bite from the Common Viper would very probably prove fatal. The remedies usually employed are the external application of oil, and the internal administration of ammonia.

The poisonous fluid is perfectly innocuous when swallowed. Dr. Mead, and others, have made this experiment, and never experienced the slightest ill effects from it. It is, however, clear that there would be danger in swallowing it, were any part of the mouth, the throat, or the œsophagus, in a state of ulceration, or having an abraded surface.

It will not perhaps be wholly uninteresting to describe briefly the very beautiful apparatus* by which the poison wounds are inflicted, which render these, and so many other Serpents, so formidable. On each side of the upper jaw, instead of the outer row of teeth which are found in non-venomous Serpents, there exist two or three, or more, long, curved, and tubular teeth, the first of which is larger than the others, and is attached to a small moveable bone, articulated to the maxillary bone, and moved by a muscular apparatus, by which the animal has the power of erecting it. In a state of rest the fang reclines backwards along the margin of the jaw, and is covered by a fold of skin; but when about to be called into use, it is erected by means of a small muscle, and brought to stand perpendicular to the bone. The tooth itself is as it were perforated by a tube, the mode of formation of which was not understood until it was demonstrated by Mr. Smith in the Philosophical Transactions for 1818. This tube, although completely enclosed, except-

* See page 65.

ing at its basal and apical orifices, must be considered as formed merely by the closing round of a groove in the external part of the tooth itself, and hence not in any way connected with the inner cavity of the tooth, in which exists the pulp upon which the substance of the tooth is formed. The base of the tooth, and consequently the basal orifice of the tube just described, is embedded in a sac, into which the poison is poured from the ducts of the glandular structure by which it is secreted, and which is believed to represent the parotid gland of the higher vertebrata. The poisonous fluid itself is inodorous, tasteless, and of a yellow colour. It is secreted in greater quantity, and its qualities are more virulent in a high temperature than in cold. Its secretion may be greatly increased by local irritation; as is evidenced by the following fact. Some years since I was dissecting very carefully and minutely the poison apparatus of a large Rattlesnake, which had been dead for some hours; the head had been taken off immediately after death; yet as I continued my dissection the yellow poison continued to be secreted so fast as to require to be occasionally dried off with a bit of rag or sponge; I believe that there could not have been less altogether than six or eight drops at the least.

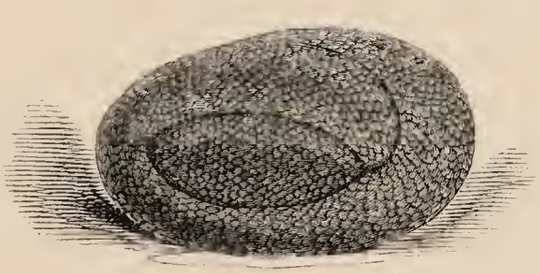
When the animal inflicts the wound, the pressure on the tooth forces a small drop of the poison through the tube; it passes through the external orifice, which is situated on the concave side of the curved tooth, and is in the form of a slit. The manner in which the blow is inflicted is as follows. The animal generally throws itself in the first place into a coil more or less close, and the anterior part of the body is raised. The neck is bent somewhat abruptly backwards, and the head fixed almost horizontally. In an instant the head is, as it were, launched by a sudden effort towards the object of its anger, and the erected tooth struck into it, and withdrawn

with the velocity of thought. It is found by experiment that the effect of subsequent wounds is greatly diminished either by the diminution of the quantity of venom, or by some deterioration of its strength; so that if a venomous Serpent be made repeatedly to inflict wounds, without allowing sufficiently long intervals for it to recover its powers, each successive bite becomes less and less effective. A gentleman of my acquaintance had some years since received a living Rattlesnake from America. Intending to try the effects of its bite upon some rats, he introduced one of these animals into the cage with the Serpent; it immediately struck the rat, which died in two minutes. Another rat was then placed in the cage; it ran to the part of the cage farthest from the Serpent, uttering cries of distress. The Snake did not immediately attack it; but after about half an hour, and on being irritated, it struck the rat, which did not exhibit any symptoms of being poisoned for several minutes, and died at twenty minutes after the bite. A third, and remarkably large rat, was then introduced into the cage. It exhibited no signs of terror at its dangerous companion, which, on its part, appeared to take no notice of the rat. After watching for the rest of the evening, my friend retired, leaving the serpent and the rat together; and on rising early the next morning to ascertain the fate of his two heterogeneous prisoners, he found the Snake dead, and the muscular part of its back eaten by the rat. I do not remember at what time of the year this circumstance took place, but I believe it was not during very hot weather.

Although there is no reason to believe that the Viper employs this powerful means of destruction for the purpose of disabling its prey before it is finally seized; but, on the contrary, all the observations which have been made upon its mode of feeding, tend to show that, like the Snake, it seizes its prey at once, and immediately begins to swallow it; yet it

is not at all improbable, considering how instantaneously the poison begins to affect small animals, that even in the act of seizing a mouse or bird, or any other victim, it may instil a sufficient quantity of venom into its system to paralyze and presently destroy it. Still the action by which it takes its prey is very different from that which it employs in its defensive attack, and resembles that employed by the innocuous tribes. Its favourite food consists of the smaller mammalia, field-mice, shrews, and similar little animals, of frogs also, though less commonly, and occasionally of birds. It does not always confine its voracity within the limits of its powers of deglutition; for I have in my possession a specimen of a small Viper which was taken on Poole Heath in Dorsetshire, in a dying state, in the act of attempting to swallow a mouse which was too large for it, the skin of the neck being so distended as to have burst in several places.

The Viper, like many others of the poisonous groups of Serpents, is ovo-viviparous. I have concluded, from the examination of many specimens both of this species and of the Rattlesnake, that it is in the act of parturition that the membrane of the egg is burst. I have examined several in which the young have appeared ready to be excluded; but have always found the investing membrane entire, although so thin and soft as to be torn by the slightest force. I give a figure of the young Viper in this state, the membrane



having been removed. It is coiled up so closely as almost to appear like a solid mass ; but no sooner is it emancipated than it assumes all the activity and virulence which belong to the species. If a female Viper about to bring forth her young be killed, and the young ones set at liberty by opening the abdomen, they will immediately crawl about, and on being irritated will throw themselves into an attitude of defence.

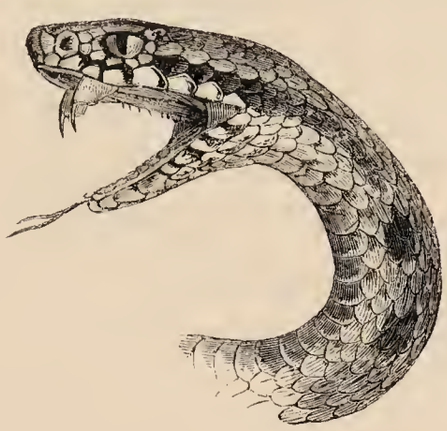
A certain degree of temperature, varying in the different classes, is requisite for the developement of the embryo. In the mammalia this temperature is afforded by the standard heat of the body of the parent, within which the young is brought to perfection ; in birds it is also, with few exceptions, communicated by the parent, but by means of incubation, or sitting on the eggs after they are excluded from the body ; in the reptilia, on the contrary; it is communicated solely by the surrounding atmosphere ; and this is equally the case whether the eggs are deposited before the growth of the embryo has commenced, or the young are perfected within the mother, and brought forth alive. In the latter case, as I have already observed, when speaking on the developement of the young of the common Viviparous Lizard, *Zootoca vivipara*, it is by the exposure of the body of the mother to the sun's rays that the necessary degree of heat is obtained ; and hence during the period of gestation it is very common to see the pregnant female Viper lying, as it were, all abroad, with flattened body, basking in the sunshine ; and at this time she is much less easily disturbed, and more tardy of flight than the male. The number of young produced at each birth varies from twelve to twenty, or even more.

TheViper, like the other reptilia, seeks a secret and secure place in which to hibernate during the cold months of the year. Here several are found entwined together, and in a very torpid condition; and if at this period a Viper be made to wound an animal with its poison-fang, no injury is likely to result

from it; the poison either does not exist at all, or it is inert.

It frequents dry sandy heaths and waste places, not requiring, like the Snake, the neighbourhood of water, nor swimming so readily as that species. In many parts of the country it is even more common than the Snake.

The name Adder, by which it is known in many parts of England and Scotland, is anciently written *nedre*, and afterwards *eddre*, the initial *n* being dropped. It is from the Anglo Saxon *nædre*,—nether, lower,—from its creeping position, and the name was applied to all the Serpent tribe. The word Viper, Latin *Vipera*, is derived from its viviparous habit.



The head is somewhat depressed, almost oval, slightly widening behind the eyes. Gape as long as the head, ascending behind. No teeth in the upper maxillary bones, excepting the poison-fangs; a row of small teeth in the palatine bone on each side. Neck rather smaller than the back of the head, from which the body increases to nearly the middle of the entire length; the rest of the body to the vent scarcely diminishing; the tail becoming almost abruptly smaller, and tapering to its extremity, which is pointed; the tail varies in its proportion to the body, but is generally not more than one-eighth of the total length, and in some even less. The head is covered with small squamous plates, which in some

specimens are regularly formed and symmetrically placed; but in others they are very irregular. There are three which are larger than the others,—namely, the vertical, and the pair of occipital plates. The scales of the back and sides are semi-oval, or somewhat lanceolate, imbricated, and distinctly carinated. They are disposed in eighteen series. The plates of the abdomen have nothing particular in their form; they vary in number, but usually consist of about one hundred and forty to one hundred and fifty, and those of the tail are about thirty-five pairs.

The general ground colour varies considerably. In some it is nearly olive, in others a rich deep brown, and in others a dirty brownish yellow; and when in high health, and shortly after having cast the skin, the surface is slightly iridescent in particular lights. A mark between the eyes, a spot on each side the hinder part of the head, and a zigzag line running the whole length of the body and tail, formed by a series of confluent rhombs, as well as a row of small irregular triangular spots on each side, all of a much darker hue than the ground colour of the body, and frequently almost black. I have a specimen in my collection which I received alive from Hornsey Wood, the ground of which was almost perfectly white, and all the markings jet black. The under parts are plumbeous in some, with lighter or darker spots, in others almost wholly black.

The tendency of this species to vary in its colours has occasioned an erroneous multiplication of species by various authors. Some of the more remarkable and conspicuous varieties I proceed to describe.

The first is the Red Viper (*V. communis*, var. β of Mr. Jenyns), described by my venerable friend the Rev. Thomas Rackett, in the twelfth volume of the Linnean Transactions. It was found by him in Cranbourne Chase in Dorsetshire, in which county I have also obtained it from Poole Heath. It varies much in the brightness and intensity of its colour.

The specimen which I here figure, and from which I give the following description, was taken in the neighbourhood of Fordingbridge, in Hampshire, and was kindly forwarded to me by Dr. Thackeray, Provost of King's College, Cambridge, by whom I am informed that, of great numbers of Vipers which

are annually destroyed in that neighbourhood, about one in ten are of the present variety.

The ground colour is a dull brick red, with the usual markings of the Common Viper, of a ferruginous brown, or mahogany colour. The marks on the head are very similar in form; but the V mark is somewhat more divergent than is usual in the common variety. The throat is white, tinged with ferruginous red, and the belly is ferruginous grey, with minute whitish dots, and a few larger dots of reddish brown. The round spots on each side of the back are rather more distinct, and somewhat smaller than in the common sort; there are also a few irregular reddish white spots along the sides of the neck; the upper lip is white, barred with brown. The only striking peculiarity in its form is the greater proportionate breadth of the head behind the eyes, which in this specimen is equal to the length of the gape.

The plates of the abdomen are one hundred and fifty; those of the tail thirty-three pairs. The following are the dimensions of the specimen here figured:—

	In.	Lines.
Total length	10	0
Length of the tail	1	1
Length of the head	0	5
Breadth of the head	0	4

A specimen has been particularly described by Mr. Strickland, in the sixth volume of Loudon's Magazine of Natural History, in the following words:—"Of a bright ferruginous red, with zigzag markings down the back, resembling in form those of the Common Viper; but instead of being black, or dark brown, they are of a deep mahogany colour; also a series of irregular spots of the same colour along each side; the zigzag line terminates at the back of the head in a heart-shaped spot, placed between two converging dark-coloured bands, which meet on the top of the head, and again diverge towards the eyes; belly ferruginous like the back." Mr.

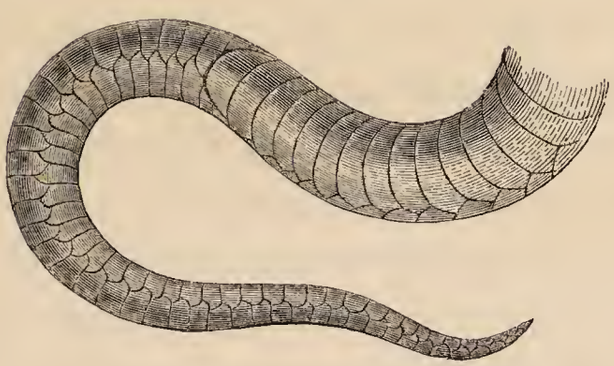
Strickland adds the fact which I have mentioned above, that the head is much broader and shorter than that of the Common Viper. The Prince of Musignano figures, in his *Fauna Italica*, as the true *Chersea*, a small Viper, considerably similar to our Red Viper, excepting in its colour, which is a light grey, with darker markings. There is in that figure, also, the greater breadth of head which is observable in our animal, together with a still more obtuse rostrum. The Prince's figure is evidently taken from a young animal, which may possibly belong to a different species. He terms the *V. Berus*, "marasso palustre," and his *V. Chersea*, "marasso alpino,"—a distinction certainly not sustained by our two varieties. After all, the question whether it be the *Coluber Chersea* of Linneus, and whether, if not so, this last-mentioned species be distinct from the Common Viper, is one of considerable doubt and obscurity.

The second variety (var. γ of Jenyns), is described as a distinct species by the Rev. R. Sheppard in the Linnean Transactions, under the name of *Coluber cæruleus*, or Blue-bellied Viper. It scarcely even deserves to be considered as a distinct variety, as the plumbeous belly by which it is characterized is rather a difference of degree than of hue.

The Black Viper, of which I give a figure, drawn from a very fine living specimen, now before me, obtained, and obligingly lent me, by Mr. Combe, is the var. δ of Mr. Jenyns. It has been figured, though but badly, and described by Dr. Leach, in his Zoological Miscellany. It is evidently a variety only of the present species, and is of a fine rich black colour, excepting under the jaw and throat, which is of a dirty white; the usual markings of the species may be seen, in particular lights, of a more intense black than the ground colour.

I have to add a fourth variety, from the specimen in

my possession, already mentioned, which I obtained from Hornsey Wood. The ground colour was of an uniform dirty white, and all the markings were of a deep full black. It was, when living, one of the most beautiful of the species I have ever seen, and offers a remarkable contrast to the black variety.



A TAIL-PIECE.

AMPHIBIA.

INTRODUCTORY OBSERVATIONS.

The doctrine of continuous affinities could scarcely receive a more striking illustration in the animal kingdom than is afforded by the interesting group constituting the Amphibia of modern authors. Intermediate in their structure, and, in many forms, in their habits and mode of life also, between the fishes and the true reptiles, they bear a still more interesting relation to these classes, in that remarkable change which many of them undergo at a certain period of life by which they become transformed from the nature and habits of the former, to those of the latter class; and thus exhibit in their own individual life a beautiful and complete example of *transition* of *organization;* a subject which constitutes one of the most important theories connected with the higher departments of Zoological science. To any person capable of appreciating the interest attached to the study of physiological phenomena, the contemplation of an animal which at one period of its life is endowed exclusively with the organs of aquatic respiration, resembling the gills of fishes, with means of locomotion adapted only to a constant residence in the water, and with a digestive apparatus fitted exclusively for the assimilation of vegetable food, assuming by degrees the function of atmospheric respiration, acquiring limbs which are formed for leaping on land with great strength and agility, and manifesting the most voracious carnivorous appetite, will not only excite feelings of the deepest admiration, but necessarily lead to the investigation of the laws by which such

extraordinary changes are governed, and of the relations which they bear to the theory of continuous affinity before alluded to, and to that of progressive developement through the whole of the animal kingdom. That such phenomena are exhibited by the typical forms of this class will be sufficiently established by the slight sketch of their structure, habits, and developement, which will presently be offered.

The AMPHIBIA have by many zoologists been considered in the light of an order of the class *Reptilia*; but the characters by which they are distinguished appear to me to be sufficiently marked and important to justify their separation as a distinct class. They may be characterised as "vertebrated animals with cold blood, naked skin, oviparous reproduction, and most of them undergoing a metamorphosis, having reference to a change of condition, from an aquatic to an atmospheric medium of respiration." "The class has been variously divided into groups, according to the different views of the naturalists by whom they have been arranged. The division adopted by many zoologists of the present day, according to the mere presence or absence of the tail in the perfect state, is not only liable to the objections which belong to all merely dichotomous arrangements, but appears to be far less natural and less consistent with the physiological characters of the groups than that which is derived from the absence or presence and the duration of the branchiæ. Thus the Frogs and Toads, which in the adult state have not the vestige of a tail, and the Salamanders and Tritons, which retain that organ through life, all agree in the early possession of branchiæ, which are subsequently lost and replaced by true lungs, and in undergoing consequently a total change in the medium of their respiration; whilst the *Proteus* and the *Siren* retain their branchiæ with lungs, (rudimentary, at least,) and probably throughout life possess synchronously the two-fold function of aquatic and atmospheric respiration.

The *Amphiuma* and *Menopoma* have not as yet been observed to possess branchiæ at any period of their existence, though further observations are necessary to warrant the conclusion of the absolute non-existence of a metamorphosis in those genera."*

As it appeared to me that no one arrangement hitherto given had sufficiently distinguished the different forms, I proposed, in the article just quoted, the following modifications as more consistent with the diversities of structure in the different groups.

Class AMPHIBIA.

Order I. ANOURA.

Body short and broad. Feet during the tadpole state wanting; afterwards four, the hinder ones long, and formed for leaping. Tail before the metamorphosis long, compressed; afterwards totally wanting. Ribs wanting. Vertebræ few and anchylosed. Tympanum open. Respiration at first aquatic by branchiæ, afterwards atmospheric by lungs. Branchiæ at first external, but withdrawn within the chest before the metamorphosis. Impregnation effected externally during the passage of the ova.

Genera. *Rana*, *Hyla*, *Bufo*, *&c.*

Order II. URODELA.

Body long, slender. Feet always four. Tail long, persistent. Ribs very short. Vertebræ numerous and moveable. Respiration at first aquatic by external branchiæ, which are never concealed within the chest; afterwards atmospheric

* See the article "Amphibia," by the author of the present work in Dr. Todd's Cyclopædia of Anatomy and Physiology.

by cellular lungs. Tympanum concealed. Impregnation effected by sexual contact, at least in most instances.

Genera. *Salamandrina*, *Salamandra*, *Molge*.

Order III. AMPHIPNEUSTA.

Body elongate, formed for swimming. Feet either four or two anterior only. Tail compressed, persistent. Respiration aquatic by means of branchiæ throughout life, co-existing with rudimentary lungs. Branchiæ external, persistent. Eyes with palpebræ.

Genera. *Proteus*, *Siren*, *Menobranchus*, *&c.*

Order IV. ABRANCHIA.

Body long, formed for swimming. Feet four. Cranium solid. Tail compressed. Respiration by means of lungs only. Branchiæ none. No metamorphosis known.

Genera. *Menopoma*, *Amphiuma*, *&c.*

Order V. APODA.

Body elongate, slender, anguiform. Feet none. Tail very short, almost wanting. Lungs one larger than the other. (The existence of branchiæ at any period of life unknown.) Ribs very short. Sternum wanting. Ears concealed. Impregnation probably internal.

Genus. *Cœcilia*.

I do not offer this arrangement either as wholly original, nor as absolutely natural; but it appears to me to be less objectionable than the others which have been proposed.

It is exclusively to the first and second order that the few Amphibia which are indigenous to this country belong; and I shall confine my observations on the general characters of the class, and on their physiological peculiarities, to

those points which may be illustrated by a reference to our own native species. The most striking external character by which the whole of these animals are distinguished is the naked skin. Whilst all the true Reptilia are covered by some hard and corneous or, at least, coriaceous modification of the cuticle, which appears in the form of plates, as in the Crocodiles and Tortoises, and in that of scales, as in the Lizards and Serpents, the Amphibia have no vestige of such a structure; the skin being in all cases soft and smooth, and in many instances always more or less moist. Some of them, as the Salamanders and the Toads, have a number of cutaneous glands which secrete a viscid fluid, which is said to be more or less acrid and irritating. This is most conspicuous in the common Salamander of Europe, which when irritated will often throw out from these glands a quantity of such white and tenacious fluid. Now the acrid quality of this secretion forms the sole ground for the reputed poisonous character of these animals; for it is a well-ascertained truth that not one of them possesses any organ by which poison can possibly be communicated. The cuticle is frequently shed, and in various modes, according to the habits of these species. Thus the cuticle of the Frog and the Water Newt comes off in shreds in the water; whilst that of the Toad is removed at once by the exertions of the animal, comes away whole, and is swallowed at one gulp. Of this very curious fact the details will be found in the description of the common Toad.

But the most interesting circumstance connected with the functions of the integuments of these animals, or indeed with any part of their economy, is their cutaneous respiration; or, in other words, the power which the surface of the skin possesses of effecting those changes in the blood which are usually performed by the lungs or branchiæ. It was ascertained by Spallanzani, that the skin of the Frog gave out

carbonic acid when in contact with the atmosphere; but the subject had never undergone that strict and philosophical investigation by which all its important bearings should be ascertained, until Dr. William Edwards of Paris entered upon the inquiry, the results of which he published in his admirable work "On the Influence of Physical Agents on Life;" than which there does not exist in the whole range of physiological literature a more perfect example of the manner in which a physiological inquiry ought to be imagined, planned, and conducted, and its results reasoned upon, and described. As I have endeavoured in the article already quoted, to give a short sketch of the principal results of Dr. Edwards's experiments, I shall now merely offer a somewhat modified quotation from that article, rather than enter at length into the detail, which, however interesting the subject may be to the physiologist, would be out of place in the present work, and would be unnecessary to those who alone could appreciate it; for where is the physiologist who has not read and admired the original work itself?

The existence of cutaneous respiration in the Frog was proved by the simple experiment of tying a piece of bladder over the head so tightly as to prevent the possibility of communication with the lungs, so as indeed to produce complete strangulation. The Frogs were then placed under water; and on examining the air contained in the vessel after an hour or two, a sensible quantity of carbonic acid was detected.

On placing Frogs in vessels filled respectively with river water, and with water which had been deprived of air by boiling, and inverted over the apertures contained in the shelf of a pneumatic trough, containing about ninety-eight pints, those in the latter lived on the average little more than half as long as those in the aërated water. On trying the effects of submersion under stagnant water frequently renewed they lived two months and a half, and then died from

accidental neglect of changing the water. The results of placing them under running water were similar. In this case they were confined in a sort of cage, and sunk in a river. The effects of temperature in all these experiments were amongst the most curious and interesting circumstances connected with the inquiry. These results prove that the duration of life under water is in an inverse proportion to the elevation of the temperature from 32 degrees to about 107, at which point the animals die almost instantly. But these effects of temperature were found to be modified by an increase of respiration, whether by their rising to the surface and breathing the atmosphere, or by the quantity of aërated water being increased.

Such is a slight glance at the results obtained with reference to the cutaneous respiration carried on through the medium of aërated water; and those connected with the atmospheric respiration of the same surface are no less conclusive. Six Frogs were taken for one of the experiments, and a ligature tied with the most rigid compression round the neck, so as to exclude any possible passage of air. One of these lived twenty days in a damp atmosphere, whilst those which were placed in five ounces and a half of water, died as soon as all the air contained in that water was respired, which was in from one to three days. Another experiment of corresponding tenour was performed by the total excision of the lungs; and of three Frogs thus treated, two died on the thirty-third, and one on the fortieth day.

The results of other experiments proved that pulmonary respiration alone is not sufficient to support life without the aid of that of the cutaneous surface.

It is very clear that this important function cannot be carried on unless the surface be constantly kept in a moist state. The branchiæ of fishes and of crustacea, and the lungs of all pulmoniferous animals, equally require that the respiratory

surface in every modification should be humid ; for as soon as it becomes dry, its function ceases, and the animal speedily dies. But as the Frog, for instance, is frequently exposed to a dry atmosphere, it is essential that there should be some provision made for a constant supply of moisture to the skin, which has just been shown to be a respiratory surface. This is effected precisely as in other surfaces which perform this function,—namely, by a secretion of fluid from the surface itself. The extent of the skin is, however, so great that the whole internal moisture of the animal would speedily be exhausted, unless a reservoir were provided for an extraordinary demand ; and I now proceed to show what this reservoir is, and by what means it is replenished. Every one knows that when a Frog is hastily seized, or even quickly pursued, it voids a considerable quantity of water, which is generally, but erroneously, supposed to be the urine. This water is limpid and pure, containing no traces of the usual component elements of the urinary secretion. It is contained in a sac, which has also been mistakenly believed to be the urinary bladder. This is the reservoir to which I have alluded. When, therefore, the Frog is happily placed in a damp atmosphere, or in water, the skin absorbs a quantity of water, which there is every reason to believe is secreted into the bladder just mentioned, where it is kept in store until the dryness of the skin requires a supply for the purpose of respiration, when it is again taken up, and restored to the surface by which it had been first absorbed.

There can be no doubt that this cutaneous respiration is of much more frequent occurrence in animals having naked and moist skin than has hitherto been ascertained; and it is exceedingly probable that it will be found to take place, not only in all the aquatic amphibia, but in the mollusca, and many others, having integuments of a similar character.

Allusion having already been made to the metamorphosis

of the typical Amphibia, I shall here offer a few general remarks upon this most remarkable phenomenon. In the whole of the tribes of Frogs, Toads, and Newts, or, in other words, in the two orders *Anoura* and *Urodela*, the young animal, as it emerges from the egg, and for a considerable time afterwards, exhibits a form and structure essentially similar to those of fishes. The organs of respiration and of circulation differ in no important point from those which exist in that class, and their mode of aquatic progression is absolutely identical. At a certain period of their growth a gradual change takes place in the structure and function of each of these systems, during which the little pisciform creature is gradually assuming the general characters of the reptile type. I shall here offer a few illustrations of the changes which take place in each of these systems, giving the detail of the various modifications which take place in the different groups, when describing each form.

The swimming of fishes is effected by the powerful lateral motions of the tail and posterior part of the trunk, and the numerous short oblique masses of muscle, which constitute the greater proportion of the bulk of those parts, are admirably adapted for the performance of these powerful and rapid movements. Such is the use, too, to which the long and powerful tail which belongs to the Tadpole is applied; and the wriggling motion given to this organ, by which the little animal is propelled through the water, by successive lateral impulses, is similar to that by which fishes are propelled. In the *Anoura* this is totally removed by absorption, and gives place to the extensive and interesting developement of the anterior and posterior limbs, particularly of the latter, which are equally adapted for leaping with great force on the land, or for a rapid and equal propulsion through the water. In the *Urodela*, as the Newts, for instance, this original mode of progression continues throughout life, and the feet which

are ultimately added to the animal's organization, are extremely small and feeble, serving only for awkward and imperfect progression on land, or along the bottom of the water.

The organs of circulation undergo a no less striking and far more important change. In the first instance the heart is single, but the circulation is complete. The blood, after its systemic circulation, is received from the veins by a single auricle, and is immediately propelled by a fleshy ventricle to the branchial arteries, of which one goes to each leaf of the gills or branchiæ. From the branchial capillaries, the aërated blood is received by the branchial veins, which unite to form an aorta without the intervention of a second ventricle. Every tyro in comparative anatomy will at once perceive that this is an exact description of the circulation in fishes; and yet it is taken from that of the Tadpole of the Newt. I shall not enter here into a detail of the changes which take place in the various vessels, by which the branchial vessels become obliterated or altered in their course, and minute branches are augmented in volume, and enter upon new functions; such details could only be understood by the experienced anatomist, and would be out of place. It is sufficient to say, that by the dilatation of one vessel a second auricle is produced; that from the last branchial artery a small branch passes to the air sac, or rudimentary lung, which ultimately becomes the pulmonary artery; and that by other no less astonishing alterations, the transformation of the branchial into the pulmonary circulation is effected, and the heart assumes its new character of a trilocular cavity; possessing, that is to say, two auricles and a single ventricle, by which the blood which is sent to the lungs, and that which is distributed to the system at large, is alike of a mixed character, as in the true Reptilia.

The respiratory organs are no less surprisingly modified during the progress of the changes just described in those of circulation. The total loss of the branchiæ, which are re-

moved by absorption, and the developement of the little rudimentary air sac, so exactly analogus to the air-bag of fishes, into the most beautiful cellular lungs, are changes which, but for the ocular demonstration to which they are yearly submitted, could scarcely be believed. Into the anatomical details of the steps by which these changes take place, it is not my intention to enter; but the general developement of the new organs, both of these functions and of that of progression, will be given in the account of each different form.

We find then that these typical forms of the Amphibia become essentially altered during the progress of their growth in all their principal systems of organization; in the nervous, the circulating, the respiratory, the digestive, and the reproductive organs: nor does reproduction ever take place in these animals until the other changes have been perfected. But in the perennibranchiate forms, as the *Siren*, the *Proteus*, &c. it seems as if the metamorphosis were stopped suddenly at that period when the lungs begin to be developed, before the branchiæ have at all diminished in size or in activity of function. The reproductive organs, however, go on to their full developement, and the animals never undergo any further change of form or habit, but continue throughout life to breathe both the atmosphere by their air cells, and water by their branchiæ, as well as either medium indifferently by means of their skin. In a word, the pulmonary, the branchial, and the cutaneous modes of respiration are in these curious animals going on simultaneously, although there can be no doubt that the branchial is the most essential to their well being, and the pulmonary the least so.

Enough has probably been said on the general physiology of these animals; for it would not consist with the object of this work to enter more minutely into the details of this part of the subject; but to the physiological enquirer, few classes of animals present a more extensive or interesting field of

investigation. After all that has been done, much remains yet to be ascertained, in the functions both of the earlier and the adult state of their existence, and in the phenomena of their transformation.

The species which belong to the British Fauna are more numerous than they have generally been supposed to be. Of the true Frogs we have two, of the Toads two, and of the Newts three, even excluding the *Triton vittatus* of Mr. Gray, which is doubtless a variety of the common species, and the British habitat of which appears to be doubtful. For the accurate distinction of the known species, we are indebted to my kind and valued friend Bibron, to whom Zoologists owe incomparably the most complete work on Erpetology that has ever appeared, and to which I have had previous occasion to allude.

Genus, *Rana*, Linn.

Generic Character.—Skin smooth, hinder legs very long, formed for leaping; the toes palmated. Teeth on the upper jaw, and on the palate.

COMMON FROG.

Rana temporaria. Linn.

Specific Character.—Reddish, or yellowish, or greenish brown, with an oblong brown spot behind the eyes; the legs with brown fasciæ.

Rana temporaria,	Linn. Syst. Nat. I. p. 357. Flem. Brit. An. p. 158. Jenyns, Brit. Vert. p. 300.
,, *aquatica,*	Ray, Syn. Quad. p. 247.
,, *fusca,*	Rosel. Hist. Nat. Ran.
Common Frog,	Penn. Brit. Zool. III. p. 9. Shaw, Gen. Zool. III. p. 96, t. xxix.
Grenouille rousse,	Cuv. Reg. Anim.

If in the natural system of animals we must look for the typical representative of any group in that form in which the distinctive characters of the whole group are most obviously and unequivocally developed,—a test insisted upon, I believe, by all who have even professed to believe in the existence of such types of form,—it is in the family *Ranidæ* that we may expect to find the typical character of the present class of animals; and the truth of this test is not invalidated by the absurd and even ludicrous instances of its breach, of which some of the most strenuous asserters of the principle have been guilty. To apply to this test only one or two of the structural or physiological peculiarities of the class. The most remarkable and important of all is the change, which has already been mentioned, from the condition of a fish to that of a reptile; and in this respect, whilst we must consider the permanent pisciform condition of the *Proteus*, the *Siren*, and others, which retain their branchial respiration throughout life, as an abnormal form leading towards the fishes, and the *Cæcilia*, on the other hand, as probably approximating the Ophidian Reptilia; the caducibranchiate groups—and especially the present family—exhibit the phenomena of this metamorphosis to the greatest extent, the change which they undergo being certainly more complete than that of any of the other forms. The cutaneous respiration is another peculiar characteristic of the class; and there is no doubt that this function also is enjoyed by the Frogs in the highest degree.

The innocent and very useful species about to be described, is one of the most common of our vertebrated animals. It is found in almost all parts of this island, wherever there is a river or a pool, or even sufficient shade to maintain the degree of moisture necessary to preserve the respirable condition of the skin; for the presence of a considerable quantity of water, although requisite for the deve-

lopement of the young, is not so for the existence and health of the perfect animal.

Of the existence of the Frog in Ireland, very erroneous opinions have been entertained. I need not again allude to the legend of St. Patrick's extirpatory malediction against the whole race of reptiles; but it is worthy of observation, that even of late years, the belief that Frogs, in common with Snakes, could not live in that favoured island was very general. The truth, however, is, that this species is not only now an inhabitant of that place, but, as will appear by the following extract, has been so since the very beginning of the eighteenth century. I owe the knowledge of this passage to my friend W. Ogilby, Esq. who communicated it to me in the following letter:—

"The following is the extract from Swift's work of which I some time since spoke to you, concerning the introduction of Frogs into Ireland. It occurs in a tract styled, 'Considerations about Maintaining the Poor,' which, though without date, I fancy from the context, and other collateral evidence, must have been written about the year 1726. Among the public grievances of which he complains, he rather singularly mentions the practice of insuring houses in English offices; which, it appears, was then becoming common in Ireland. 'A third,' [absurdity] says he, 'is the Insurance Office against fire, by which 'several thousand pounds are yearly remitted to England, (a trifle, it seems, we can easily spare,) and will gradually increase till it comes to a good national tax; for the society-marks upon our houses, (under which might be properly written, 'The Lord have mercy upon us,') *spread faster and farther than a colony of Frogs.*' To this passage, one of Swift's editors, I believe Sheridan, adds the following note:—'This similitude, which is certainly the finest that could possibly have been used upon the occasion, seems to require a short ex-

planation. About the beginning of the eighteenth century, Dr. Gwythers, a physician, and fellow of the University of Dublin, brought over with him a parcel of Frogs from England to Ireland, in order to propagate the species in that kingdom, and threw them into the ditches of the University park, but they all perished. Whereupon he sent to England for some bottles of the Frog spawn, which he threw into those ditches, by which means the species of Frogs was propagated in that kingdom. However, their number was so small in the year 1720, that a Frog was nowhere to be seen in Ireland except in the neighbourhood of the University Park ; but within six or seven years after, they spread thirty, forty, or fifty miles over the country, and so at last by degrees over the whole nation.' What credit may be due to the note I will not take upon me to determine, though it appears perfectly circumstantial, and given upon the editor's personal knowledge ; but Swift's own notice proves indisputably the fact of the introduction, and the period about which it took place."

The respiration in this animal is, as has already been stated, both pulmonary and cutaneous. The former function, that of breathing by lungs, is effected not by successive alternations of contraction and dilatation of the chest,—a movement which, as the Frog possesses no ribs, is impossible,—but by the act of swallowing air, as in the case of the Testudinata before described. The mechanism by which this act is performed is precisely the same in both cases ; the air is inhaled through the nostrils by the dilatation of the pharynx, the œsophagus being closed to prevent its passing into the stomach ; then the posterior openings of the nostrils being also closed by the application of the tongue, the pharynx is contracted, and the air forced into the lungs. These organs are of considerable size, lying on each side of the anterior part of the vertebral column ; they consist of

large cells separated by the most beautifully delicate diaphanous parietes. From this peculiarity in the respiration, it follows that it can only be performed when the mouth is closed; and that if the mouth be gagged open, the animal soon perishes from the cessation of pulmonary respiration.

The ordinary voice of the Frog is too well known to require particular description. It is termed croaking, and is principally heard during the season of sexual excitement. In the spring every one has heard the neighbourhood of ponds and ditches, where these animals abound, resounding with their loud yet not disagreeable notes. When great numbers are congregated together, the noise heard at a considerable distance is far from being unmusical, and, when associated with the return of the genial season, and the calm of a still mild evening, is far more pleasant and soothing than many a more fashionable and dearly-bought musical entertainment.

The food of the Frog usually consists of various kinds of insects, and of the small species of slug. So voracious are its habits during the whole of the season at which it feeds,—for, like other cold-blooded terrestrial animals, it passes the cold part of the year in entire abstinence,—that it might become a most important assistant to the gardener or the farmer in the destruction of those pests of the respective objects of their culture which I have just named. It will swallow large coleopterous and other insects whole, and will take several of them at a meal. The quantity of insects and of slugs, indeed, which would be destroyed by encouraging these animals, instead of wantonly and unnecessarily persecuting and killing them, would be advantageous to a much greater extent than could at first sight be believed. This consideration ought surely to weigh even with those who are inaccessible to the appeals of humanity, in favour of this innocent and much-persecuted race.

The manner in which the Frog takes its food is very inter-

esting. As in the Toad, the tongue is doubled back upon itself when at rest; and being embued with a viscous secretion at the extremity, it is suddenly thrown forwards upon the insect, which, being caught by the adhesive matter upon it, is instantly drawn into the mouth by the sudden return of the tongue to its former position, and is then swallowed. This is but the work of an instant; and, indeed, is performed with such rapidity, as scarcely to be detected without careful watching.

Like the rest of the Amphibia and the Reptilia, the Frogs retire, on the approach of winter, to their hibernating retreats, where they pass the dreary season in a state of absolute torpidity. This is generally in the mud at the bottom of the water, where they are not only preserved in a nearly equal temperature, though at a low degree, but also secured from external injury. Here they congregate in multitudes, embracing each other so closely as to appear almost as one continuous mass. On the return of spring they separate from each other, emerge from their places of retirement, and recommence their active life by exercising the important function of the reproduction of their species. Here we enter upon the most interesting scene in the history of these animals; for it is here that the peculiar characters which distinguish them from all other forms, are most strikingly shown; and I shall, therefore, enter somewhat in detail into the different steps of the developement of the embryo, and of the changes which take place in the structure and habits of the young animal as it advances towards its perfect condition.

The impregnation of the female Frog is effected in a peculiar and very remarkable manner. Whilst in the reptilia, as in most of the superior vertebrate animals, as well as in many of the lower classes, the application of the vivifying fluid to the ova, is rendered certain by actual insertion within

the body previously to their expulsion,—and in the fishes, this is effected after their actual depositions,—in the Frog it takes place during the passage of the eggs from the body of the parent. As the season of spring advances, the renewal of active existence after its temporary suspension is evinced by the most energetic action of the procreative orgasm. The male Frog leaps on the back of the female, and grasps her behind the arm-pits with his fore legs, for which purpose a temporary developement of a warty protuberance takes place on the thumbs, by means of which his hold is rendered more firm and secure. So powerful is this instinct of adhesion, that instances are not unfrequent of male Frogs seizing upon and remaining firmly attached to the surface of large fishes, from which they have not been detached without considerable force. Izaak Walton quotes a passage from an ancient writer which appears to refer to a fact of this kind. "But before I proceed further," says honest Izaak, "I am to tell you that there is a great antipathy betwixt the pike and some Frogs; and this may appear to the reader of Dubravius (a Bishop in Bohemia), who, in his book of Fish and Fishponds, relates what, he says, he saw with his own eyes, and could not forbear to tell the reader, which was—'As he and the Bishop of Thurgo were walking by a large pond in Bohemia, they saw a Frog, when the pike lay very sleepily and quiet by the shore side, leap upon his head; and the Frog having expressed malice or anger by his swoln cheeks and staring eyes, did stretch out his legs, and embraced the pike's head, and presently reached them to his eyes, tearing with them and his teeth those tender parts.'" It appears by the sequel that the bishop's fisherman assured him that "pikes were often so served." Now, although there is evidently here much of the exaggeration which may naturally be expected from the astonishment of ignorance, yet there is no reason to doubt that the main facts are true. It happens,

too, that the sex of the Frog is incidentally and unwittingly furnished by the writer by his mention of the "swoln cheeks," which he attributes to the creature's malice against his formidable enemy.

I have often heard my father relate an instance of a similar fact, though with somewhat more adherence to the simple truth of the case. As he was walking in the spring on the banks of a large piece of water at Wimpole, the seat of Lord Hardwicke, he observed a large pike swimming in a very sluggish manner near the surface of the water, having two dark-coloured patches on the side, which he thought must be occasioned by disease. A few days afterwards he saw the same pike floating dead upon the surface of the water, and having drawn it to land by means of a stick, he found that the dark-coloured masses, which he had observed on the former occasion, were two living Frogs, still attached to the fish, and that so firmly, that it required some force to push them off with the stick. There can be no doubt that the diseased state of the pike facilitated the approach and adhesion of the Frogs, to which they were primarily impelled by the sexual instinct before mentioned.

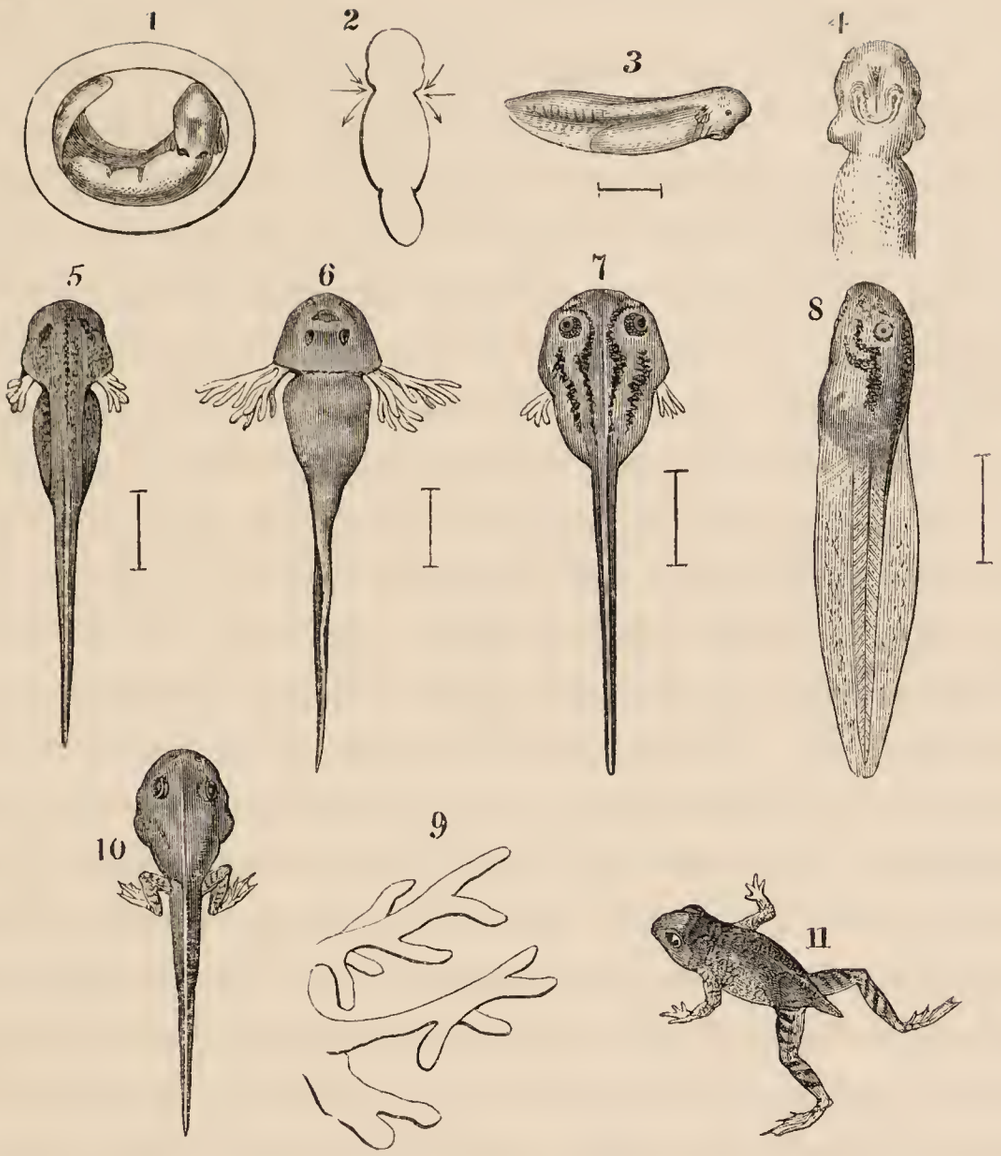
During the cohesion of the two sexes, then, the female commences the deposition of the spawn, which is fecundated during its passage. When first expelled it consists of numerous small opake globular bodies, enveloped in a small glairy, or glutinous mass. This latter substance soon absorbs a large quantity of water, and, in the course of an hour or two, each becomes not less than a quarter of an inch in diameter. The consequence of this augmentation in the bulk of the transparent mass, surrounding each embryo, is, that all the latter are removed from each other by a whole diameter of each globe; and they appear like black dots regularly distributed throughout a large mass of transparent jelly.

The deposit of the eggs takes place at the bottom of the

water, notwithstanding the assertion of some naturalists, and of Rösel amongst them, that they are expelled at the surface. The mistake, probably, arose from the mass of eggs being generally found at the surface; but this arises merely from the disengagement of gas in the substance of the glairy envelope, in consequence of partial decomposition.

The changes which now begin to take place in the embryo are most interesting. They have been detailed in a very minute and satisfactory manner by Rusconi in his work, already alluded to; and I have taken considerable pains during the last spring to follow out his investigations, and by actual observation to correct or confirm his account. I may here observe, once for all, that with the exception of a few of the details in the earliest periods, I have been able to satisfy myself of his correctness; and in those points, I believe that I only failed to do so, partly by my not having obtained the ova immediately after their expulsion, and partly by the want of time to enter into all the necessary minutiæ of the investigation.

I have also to observe that the developement of the young is more or less rapid, according to the temperature of the atmosphere; and that I was enabled to retard or hasten it by regulating this circumstance. I therefore kept my reservoir of eggs in a very cold situation, and occasionally brought a few of them into my drawing-room for the purpose of observation; in which place, being in an elevated temperature, the developement became very rapid. As my object, therefore, was to ascertain positive facts, rather than the periods of the changes, which were dependant upon variable circumstances, I kept no register of the temperature or of the periods; and I shall, in both these particulars, give some of the statements of the accurate Rusconi.



The embryo is found, in the first place, to consist of a small globular body, one side, or hemisphere, of which is of a dark brown colour, the other being much paler. In a very short period after the egg is deposited,—four hours, according to Rusconi,—a deep furrow across the dark hemisphere divides it into two equal parts, and this is soon afterwards crossed by another at right angles ; a third and a fourth furrow are produced, and so on, until the whole surface of this side of the sphere is, as it were, granulated. This appearance, however, is but transitory, the surface soon becoming almost smooth. In the course of the second day, the sphere

begins to elongate, and a groove, which had previously divided the upper part of it into two equal parts, begins to close up. The head becomes prominent, the tail begins to show itself, the little hooks by which it subsequently lays hold of objects and supports itself, begin to appear. At this period the examination becomes more easy, and more interesting. At somewhat more than fifty hours in an elevated temperature, the head is very well marked, the tail somewhat elongated, and even the rudiment of the membrane, or web, which is destined to form its fin, is visible. About this time, also, a small projection takes place on each side of the head, which is the earliest indication of the branchiæ, and the muscles of the spine may just be seen. In figure 2 of the woodcut, I have given an outline of the embryo in this condition. At this time the water is seen to flow in a distinct and rapid current to the branchial orifice over the rudiments of the branchiæ, which are now just visible, the course of which current I have indicated by arrows. These parts gradually become more developed; the body is more elongated, the branchiæ more distinct; the fin extends round the tail and partly over the back; and the head is distinguished from the body by a slight contraction at the neck; and a short period more suffices to bring it to the condition represented in figures 3, 4, of the woodcut, in which the branchiæ are seen to consist of two tubercles on each side, as yet simple and undivided; the holders, which are small simple organs placed near the situation of the future mouth, and which serve to enable the little animal to attach itself by means of a viscid secretion at their extremities, have become longer, the web, or fin, is also enlarged. By this time the first voluntary motion of the embryo is discovered on the application of any means of excitement or disturbance; but it consists only of a slight movement of the head or tail. The nostrils are seen more distinctly, but the mouth is

scarcely yet observable, and shortly afterwards the eye, in a rudimentary state, may be just discerned. The next step in the developement is a slight division of the branchiæ into lobes, and the appearance of that beautiful and interesting phenomenon, the circulation of the blood through these organs. The embryo, which is still confined to a curved position by the envelopes (fig. 1), is now seen frequently to extend itself by sudden jerks, as if to emancipate itself from its confinement, which it eventually does by tearing the membrane of the egg. The Tadpoles, we see, are now hatched (fig. 5). According to Rusconi, this takes place within four days after the deposit of the eggs, in a temperature varying only from 23° to 27° Centigr. (73°.4 to 80°.6 Fahr.); but certainly in our own climate, in the ordinary temperature of our spring, it does not take place until at least a month. As I before observed, the developement may be greatly hastened by a constant elevation of temperature, and I was often surprised at the degree to which this was the case in the course of my own observations; but the comparatively low temperature of our spring, and the cold frosty nights which occur in March and April, may well account for such a discrepancy. If the eggs be deposited at the middle or latter end of March, it is generally, with us, the latter end of April before they are hatched. The situation of the mouth is now distinctly visible, though the opening is but small; and even when it becomes considerably enlarged it has no power of movement, and there are no distinct lips. The branchiæ now speedily enlarge, and each of the two branches on either side is seen to consist of about four leaves (figs. 6. 9); these are sessile upon the body or stem of the branchia; they are somewhat granular on the surface, and slightly irregular in their form; there is also frequently a short additional branch at the base of the posterior one, as is shown in the outline, figure 9. The present state of these organs, which have now arrived at their

maximum of developement, constitutes one of the most charming objects for microscopic observation which can be conceived, and to view which a very high power is not necessary, nor even desirable. The current of the blood poured in regular pulsations at each contraction of the heart, passes up each stem or main branch of the branchiæ, and a distinct stream is given off to each leaf; it is propelled to the extremity, and then returns down the opposite sides in the most regular manner, and the parts are so transparent that every globule of blood is distinctly and beautifully visible.

This state of things, however, is destined to last but a short time. No sooner have these interesting organs attained their greatest developement than they begin to diminish in size; they become obtuse (fig. 7), and are gradually so reduced as to be withdrawn within the branchial cavity, and concealed by a little operculum of the integument. The eyes are now perfectly formed. The holders have become much diminished in size; the mouth has acquired moveable lips, and has changed its position from the inferior part of the head to near the extremity, and the little creature which has hitherto derived its sustenance either from its own resources or by absorption, now seeks its food amid softened and decomposing vegetable matter. The caudal web (fig. 8) has, therefore, become considerably developed, and serves for very rapid as well as varied locomotion. The colour of the body, too, has undergone a considerable change, having become of a soft olive green, the abdomen being dotted with golden yellow.

The Tadpole now undergoes but little change in its external form for a considerable time, but increases rapidly in bulk, and by and by a little tubercle appears on each side of the vent, which is the rudiment of the posterior extremity; this soon acquires somewhat the form of the perfect limb, the toes budding, as it were, at the extremity, but it still con-

Madeira, November 1838.

PROSPECTUS.

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